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(54) Self-bearing tyre for motor-vehicle wheels incorporating elastic-support inserts in the sidewalls

Selbsttragender Luftreifen für Kraftfahrzeugräder mit in die Seitenwände eingearbeiteten elastischen Trageinsätzen

Pneumatique autoportant pour roues de véhicules à moteur incorporant des inserts de soutien élastiques dans les flancs

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Description

The present invention relates to a self-bearing tyre for motor-vehicle wheels incorporating elastic support inserts in the sidewalls, of the type comprising a carcass, a tread band disposed crown-wise to said carcass, an a circumferentially-inextensible annular belt structure, overlying said carcass so as to form an annulus at a radially inner position to said tread band, comprising: a pair of circumferentially inextensible reinforcing rings, each inserted in a bead defined along an inner circumferential edge of a tyre; a pair of elastomeric fillers each of which extends along an outer circumferential edge of one of the reinforcing rings tapering away from the tyre axis; at least one carcass ply exhibiting its edges folded back around the reinforcing rings and elastomeric fillers; at least a pair of annular elastic support inserts of lenticular sectional form, made of elastomeric material, each of which is applied to the carcass ply against the inner part of one of the tyre sidewalls extending radially between one of the beads and the corresponding edge of the belt structure.

It is known that there are motor-vehicle tyres provided with a self-bearing carcass, that is capable of bearing the vertical loads and drift thrusts transmitted to the tyre even when it is under completely deflated conditions. In this way, in case of puncture of one or more tyres, the motor-vehicle will be still able to travel over rather long distances even at relatively high speeds, without important losses occurring in terms of road-holding and ride comfort.

One known type of self-bearing carcass substantially provides that an annular support insert of lenticular sectional form and made of elastomeric material be associated with each of the tyre sidewalls, said insert being applied to the carcass ply or plies which, as known, are provided in the tyre itself. These inserts having relatively high thickness and modulus of elasticity, are adapted to bend so as to offer sufficient elastic reaction to the vertical loads and horizontal drift thrusts transmitted to the tyre in a deflated condition.

In order to enable elastomeric inserts of smaller thickness and lower modulus of elasticity to be used, so as to improve the ride comfort and reduce the heat generation within the tyre, according to another known type of self-bearing carcass each of the tyre sidewalls is provided with two annular elastomeric support inserts disposed in side by side relation with respect to each other, at least one of which is interposed between two carcass plies.

The applicant has recently studied and set up another type of self-bearing carcass described in the European Patent Application EP-495.375 in which, for each tyre sidewall, an annular elastic support insert is provided which is arranged inwardly of the sidewall, against a first carcass ply. Combined with this elastic support insert is a pair of annular reinforcing inserts disposed substantially in radial alignment relationship between the first carcass ply and a second carcass ply laid on top of the first ply. The reinforcing inserts are consecutively connected to each other at a junction point located at the height of the maximum-thickness area of the support insert and substantially coincident with the maximum-chord point of the tyre.

During the tyre use the elastic support insert is deformed in the presence of bending stresses in order to elastically counteract the mutual approaching of the reinforcing inserts that substantially behave as stiff arms mutually hinged at their junction point.

In accordance with the present invention it has been found that by providing the elastic support insert with a substantially stiff core occupying at least the maximum-chord point of the tyre, and more exactly the area in which compressive deformations are greatly concentrated, an important increase in the carcass lift under deflated conditions of the tyre is achieved, although very soft materials are adopted for making the remaining part of the support insert so as to greatly improve the ride comfort under any use condition.

EP - A 0 005 399 on which the preamble of present claim 1 is based discloses a tyre with an elastic insert comprised by two side-by-side disposed portions, of which the axially inner portion extends from the bead to past over the corresponding side edge of the belt, the axially outer portion extends from the bead core to past over the maximum width region of the tyre, with significant overlapping between the facing portions.

The present invention relates to a self-supporting tyre of the above type that is characterized in that each of said annular elastic support inserts comprises: a counter core of substantially lenticular sectional form defining the outer end portion of the elastic insert, positioned partly in an area of maximum axial width of said insert, said counter core substantially extending from the maximum width region of said tyre to said one side edge of said belt structure and having an axial outwardly facing abutment side of convex profile facing said carcass ply and partly in contact therewith; an elastically deformable cover defining the inner end portion of the elastic insert, contacting the counter core at least partly on said convex abutment side thereof, said cover substantially extending from the bead core to at most the maximum width region of said tyre, said cover having a dynamic modulus which is lower than a dynamic modulus of said counter core.

In another aspect the tyre of the invention provides a carcass which further comprises, within each tyre sidewall, a first and a second annular reinforcing insert made of elastomeric material, interposed between one carcass ply and a second carcass ply disposed upon the first carcass ply, said first and second reinforcing inserts exhibiting a substantially lenticular section becoming thinner towards the ends, and being mutually interconnected at a junction point located substantially at the height of the maximum-thickness area of the elastic support insert.

In one embodiment, the counter core defines a radially external terminal end portion of the elastic support insert. In greater detail, the counter core substantially extends from the maximum-chord region exhibited by the

tyre under deflated conditions, to near the side edge of the belt structure. In said maximum-chord region the counter core has its maximum-thickness area.

In said one embodiment che cover coats the abutment side of the counter core from a radially internal end thereof to near the maximum-thickness area of the core itself, the remaining part of the abutment side being applied against said carcass ply.

In a second embodiment, the counter core is completely disposed substantially at the maximum-width point of the tyre and the cover completely coating said abutment side defines both the inner and outer end portions of the elastic support insert. In this case, the cover at the counter core preferably has a minimum thickness lower than 2.5 mm.

The counter core, optionally made of elastomeric material incorporating reinforcing fibers, preferably has a dynamic modulus included between 8 and 12 Megapascal (MPa) and low hysteresis loss (tan δ less than 0.1).

In accordance with a further feature of the invention, the sectional surface extension of the counter core is included between 30% and 60% of the overall surface extension in section of said elastic support insert.

It is also preferentially provided that the counter core should exhibit a maximum radial extension included between 1/4 and 3/4 of the overall radial extension of said elastic support insert.

In accordance with a further feature of the invention, the dynamic modulus of the cover is preferably included between 2 and 6 MPa.

Further features and advantages will become more apparent from the detailed description of preferred embodiments of a self-bearing tyre for vehicle wheels incorporating elastic support inserts in the sidewalls in accordance with the present invention, given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

- Fig. 1 shows the cross-sectional profile, interrupted at the equatorial plane, of one embodiment of a tyre made in accordance with the present invention, in a normally inflated condition;
- Fig. 2 is a sectional view of the tyre profile shown in Fig. 1 in a flat-ride condition;
- Fig. 3 shows the cross-sectional profile, interrupted at the equatorial plane, of a second embodiment of the tyre of the invention, in a normally inflated condition;
- Fig. 4 is a sectional view of the tyre profile shown in Fig. 3, in a flat-ride condition.

Referring to the drawings a self-bearing tyre for motor-vehicles incorporating elastic support inserts in the sidewalls in accordance with the present invention, has been generally identified by reference numeral 1.

Tyre 1 comprises a carcass 2, preferably of the radial type, around which, as known, there is defined a tread band 3 in the form of an annulus and arranged to act in abutment on a roadway 4, a belt structure 12, disposed crown-wise to said carcass, and two sidewalls 5 (only one of which is shown) extending in a substantially radial direction from the opposite edges of the tread band 3 and terminating in two beads 6 (only one of which is shown) defined along the inner circumferential edges of the tyre 1. At the beads 6 the tyre 1 is engaged to a mounting rim 7 so as to define a motor-vehicle wheel.

Carcass 2 conventionally comprises a pair of circumferentially inextensible reinforcing rings 8 commonly referred to as "bead cores" each of which carries, along the outer circumferential edge thereof, an elastomeric filler 9 tapering away from the tyre axis. The reinforcing rings 8, each of which is inserted in one of the beads 6, give said beads the necessary stiffness to ensure that the mounting rim 7 will hold the tyre 1 in the best manner.

In addition, carcass 2 has at least one carcass ply 10 extending along the whole tyre section and exhibiting its opposite edges folded back around the respective reinforcing rings 8.

In a preferential embodiment, a second carcass ply 11 is also provided which is disposed upon the first carcass ply 10 and also exhibits its edges folded back around the respective bead cores 8.

Still in a manner known per se, said circumferentially inextensible belt structure 12 is comprised of one or more belt bands 12a, 12b which are superposed like an annulus on the carcass plies 10, 11.

For the sake of clarity, in the accompanying drawings the various carcass plies 10, 11 and belt bands 12a, 12b are merely represented by blackened solid lines, spaced apart from each other. Actually, said plies are superposed in mutual contact relationship, except at the sidewalls 5, as will be better clarified below.

In accordance with the present invention, the tyre 1 further comprises, at each sidewall 5, at least one annular elastic support insert 13 applied to the first carcass ply 10, at an axially inner position relative to the tyre 1. The elastic support insert 13 extends radially between the respective bead 6 and the corresponding edge of the belt band 12 following a profile of substantially lenticular section. In greater detail, the elastic support insert 13 has a central area of maximum thickness 13a disposed substantially at the same height as the maximum-chord point, that is the maximum-width point, of the tyre 1. More specifically, this maximum-thickness area is located at the maximum-chord point taken by the tyre 1 under deflection conditions, in the absence of inflating pressure. Departing from this maximum-thickness area 13a in a substantially radial direction, is an inner end portion 13b tapering substantially towards the filler 9 and an outer end portion 13c tapering substantially towards the side edge of the belt band 12.

In an original manner, the elastic support insert 13 comprises a counter core 14 of substantially lenticular section occupying at least partly the maximum-thickness area 13a and exhibiting an abutment side 14a of convex profile facing the carcass plies 10, 11. Combined with the counter core 14 is an elastically deformable cover

coating the counter core at least on part of the abutment side 14a thereof.

The counter core 14 is made of elastomeric material having a high dynamic modulus, higher than 6 MPa and preferably included between 8 and 16 MPa. The counter core also has low hysteresis loss (tan δ lower than 0.1).

It is pointed out that all values relating to dynamic modulus and hysteresis loss (tan δ) cited in the present description are intended as measured on a test piece of elastomeric material and cylindrical form (14 mm diameter, 25 mm length) preloaded with an axial deflection of 20% and submitted to a cyclic sinusoidal deformation of a width of ± 7.5% and frequency of 100 Hz, the temperature being 100°C.

Measurements are carried out on the test piece put in an oven so as to ensure a constant temperature during the test, and after a conditioning time corresponding to 100 cycles of sinusoidal deformation.

Conveniently, in order to give the counter core 14 a dynamic modulus high enough, reinforcing fibers such as aramide, nylon or the like can be optionally incorporated in the elastomeric material used for making said core.

The cover 15, in turn, is made of elastomeric material having a dynamic modulus preferably ranging between 2 and 6 MPa and at all events lower than the dynamic modulus of the counter core 14.

In the preferential solution shown in Figs. 1 and 2, the counter core 14 substantially extends from the maximum-width region of the tyre 1 to one side edge of the belt structure 2, so as to define the outer end portion 13c of the elastic support insert 13. Preferably, the maximum-thickness area of the core 14 is coincident with the maximum-thickness area of the elastic support insert 13 and, at all events, is substantially located in register with the maximum-chord area exhibited by the tyre 1 under deflated conditions.

Still referring to Figs. 1 and 2, the cover 15 defines the inner end portion 13b of the insert 13 and coats the abutment side 14a of the counter core 14 starting from the radially inner end of said core and going as far as the maximum-thickness point of the same. The remaining part of the abutment side 14a which is not coated with cover 15, is directly applied against the first carcass ply 10.

In the embodiment shown in Figs. 3 and 4 a smaller counter core 14 than above is provided, which is located at the maximum-thickness area 13a of the insert 13. In this case the cover 15 coats the core 14 over the whole extension of the abutment side 14a and defines both the inner and outer end portions, 13b and 13c, of the insert 13.

As viewed from Figs. 3 and 4, the cover 15 becomes remarkably thinner, due to the presence of the core itself, at the maximum-thickness area 13a of the elastic support insert 13 taken as a whole. Under this situation the cover 15 at the maximum-thickness area 13a of the elastic support insert should preferably exhibit a minimum thickness included between 1 and 2.5 mm, so as to suitably isolate the counter core from the carcass ply 10. However it is also possible that the abutting side 14a of core 14 should extend within the cover 15 as far as it touches the first carcass ply 10.

It is noted that the dimensional ratios between the counter core 14 and cover 15 as well as the values of the respective moduli can vary even to a great extent, depending on the operational features to be given to the tyre 1.

As a rule it is possible to state that, the overall section of the elastic support insert 13 being equal, a size increase in the counter core 14 section brings about an increase in the lift and direction steadiness under flat-ride conditions. In the connection it is noted that the embodiment shown in Figs. 1 and 2, in which the counter core 14 extends as far as the belt structure edge, is particularly adapted to give excellent performance in terms of direction steadiness, resistance to shift thrusts and lift, under flat-ride conditions.

On the contrary, a size reduction in the counter core section will tend to improve the ride comfort. In the connection it is noted that the embodiment shown in Figs. 3 and 4 is particularly adapted to offer an excellent ride comfort under normal ride conditions, that is when the tyre is inflated to the normal pressure.

It is pointed out just as an indication that when the tyre 1 is to be used for normal road cars, the section of the counter core 14 should preferably be in the range of 30% to 60% of the overall section of the elastic support insert 13. In addition, still as a preferential solution, when the tyre 1 is under normal inflation conditions the maximum radial extension of the counter core 14 should be included between 1/4 and 3/4 of the overall radial extension of the elastic support insert 13.

In both of the above described solutions, first and second annular reinforcing inserts 16, 17 are provided to be interposed between the first and second carcass plies 10, 11 at each of the tyre sidewalls 5; they are of substantially lenticular form in section and become thinner to the ends. These reinforcing inserts 16, 17 are in consecutive alignment moving radially away from the tyre axis and are interconnected with each other at a junction point 18 located substantially adjacent the maximum-thickness middle area 13a of the elastic support insert 13.

In greater detail, the first annular reinforcing insert 16 has the respective middle portion 16a disposed in side by side relation with the inner end portion 13b of the elastic support insert 13, substantially at the height of the end edge 9a of the corresponding filler 9. Departing from this middle portion 16a is a radially inner portion 16b extending alongside the filler 9 and substantially tapering to the reinforcing ring 8, as well as a radially outer portion 16c that becomes thinner away from the filler, tapering close to the junction point 18.

The second annular reinforcing insert 17 in turn has a middle portion 17a which is disposed in side by side relation with the outer end portion 13c of the elastic support insert 13, at the connection area, commonly referred

to as "buttress" and denoted by 5a, between the tread band 3 and the corresponding sidewall 5. Departing from the middle portion 17a of the second reinforcing insert 17 is a radially inner portion 17b tapering towards the filler 9 until the junction point 18, as well as a radially outer portion 17c tapering towards the underside of a corresponding edge of the belt structure 12.

The reinforcing inserts 16, 17 are made of elastomeric material having a dynamic modulus preferably ranging between 4 and 6 MPa, and at all events higher than the dynamic modulus of the cover 15 belonging to the elastic support insert 13.

The dimensional features of the reinforcing inserts 16, 17 as well as those of the elastic support insert 13, can vary depending on the type of vehicle for which the tyre 2 is intended, and on the operating features that the tyre must possess.

As a rule, the thickness of the reinforcing inserts 16, 17 and the elastic support insert 13 is reduced when the tyre 1 is intended for light-in-weight cars and/or in order to enhance the carcass strength at high speeds rather than the carcass life under flat-ride conditions. Just as an indication, when the tyre 2 is intended for use in normal cars the thickness of the first reinforcing insert 16 should be conveniently included between 2.5 mm and 7 mm at the middle area 16a, whereas the thickness of the second reinforcing insert 17, reference being still made to the middle area 17a thereof, must be preferably included between 2.5 mm and 5 mm. The elastic support insert 13, in turn, will preferably have an overall thickness ranging from 5 mm to 15 mm, at the maximum-thickness area 13a thereof.

In addition, the thickness of the first and second reinforcing inserts 16, 17 at the point of mutual junction 18 should preferably be less than 3.5 mm.

It should be noted too that if the tyre 1 is of the tubeless type the whole inner surface of the carcass 2 will be coated with an air-tight sealing layer 19 made of elastomeric material based on a butyl blend for example.

The operating behaviour of the tyre of the invention described above mainly as regards structure is as follows, reference being made to the more complicated embodiment provided with two carcass plies 10 and 11.

It is to be stated first of all that especially when the tyre is in a deflated condition, the first and second reinforcing inserts 16, 17 enclosed between the first and second carcass plies 10, 11 substantially behave as two hinged arms, designed to rotate with respect to each other at the junction point 18 in order to assist the sidewall 5 deformations in a radial direction. Meanwhile, they elastically react substantially behaving like counter-bent leaf springs so as to inhibit deformations of the sidewall 5 resulting from drift thrusts oriented parallelly to the tyre axis and taking place when there is a bend during the car ride.

The elastic support insert 13, in turn, substantially behaves like a spring counteracting the tendency of the first and second reinforcing inserts 16, 17 to move close to each other by effect of the load weighing on the motor-vehicle wheel as well as of possible drift thrusts. In the connection it will be noted that the bending produced on the elastic support insert 13 is such that the maximum-thickness area 13a of said insert will tend to move axially to the outside of the tyre 1, so as to advantageously keep the carcass plies 10, 11 tensioned. This tensioning, which is on the other hand resisted by the consequent bending produced on the reinforcing inserts 16, 17, ensures the absence of localized compressive stresses on the carcass plies 10, 11 that would be greatly dangerous for the structural integrity of the tyre 1.

It is to be noted that said ply tensioning phenomenon as a consequence of the bending produced on the elastic support insert 13 and the resulting displacement of the maximum-thickness area thereof, also takes place in a tyre having a single carcass ply, where the beneficial effects of said phenomenon are present as well, although to a reduced degree.

During a normal use of the tyre 1 the load weighing on the wheel is almost completely resisted by the air pressure within the tyre. Under this situation, as shown in Figs. 1 and 3, the elastic support insert 13 is only slightly bent and during the ride the dynamic stresses due to the presence of asperities on the roadway 4 are efficiently taken up by the elastic deformations imposed to the cover 15 of the elastic support insert 13. Advantageously, by virtue of the low dynamic modulus of the elastomeric material forming the cover 15, said dynamic stresses are substantially taken up without reaction forces being transmitted to the mounting rim 7 and hence the motor-vehicle structure.

Therefore the optimal conditions for a comfortable ride are achieved. In the connection it is also to be pointed out that under conditions of normal inflation pressure the counter core 14 is little concerned with said dynamic stresses and consequently does not transmit forces of noticeable amount to the tyre structure.

Referring now to Figs. 2 and 4, should the tyre 1 undergo a partial or complete loss of air pressure, as a result of a puncture for example, the vertical loads transmitted to the motor-vehicle wheel are exclusively resisted by the elastic reactions resulting from the deformation of the sidewalls 5.

Under this situation the counter core 14 provided in each of the sidewalls 5, due to its high dynamic modulus, can withstand, without undergoing excessive elastic deformations, all compressive thrusts resulting from the important elastic deformation imposed to the cover 15, greatly bent around the core itself.

In conclusion, since the counter core 14 is located in the respective elastic support insert 13 just at the area where the greatest compressive efforts tend to concentrate, it prevents the elastomeric material forming the cover 15 and having a low modulus from collapsing by effect of said stresses.

The presence of the counter core 14 also protects the coating layer 19 from wear and overheating phenomena due to rubbings occurring at the maximum-chord point of the tyre, thereby eliminating the necessity of

introducing into the material used for making the coating layer, lubricants or other additives that could impair the air-tightness thereof.

As clearly shown in Figs. 2 and 4, the outer cover 15 is substantially undeformed at the areas of reduced thickness, disposed close to the counter core 14, whereas important swellings are present at the radially internal end portion 13b (Fig. 2), or at the end portions 13b, 13c (Fig. 4) of the elastic support insert 13, that is to say where the cover faces the inner part of the tyre 1.

This situation brings about an excellent distribution of the compressive efforts in the section of the elastic support insert 13, unlike the behaviour of any type of known self-bearing carcass where the compressive efforts were concentrated at the maximum-chord point of the tyre and tended to produce localized overheatings.

It will be also recognized that the presence of swellings at the end portions 13b, 13c of the elastic support insert 13 is evidence of the presence in the cover 15 of basically tensive surface efforts, that is efforts capable of eliminating any risk of overheating due to localized rubbings in mutually contacting surfaces.

Therefore, as compared to the known art, the invention has achieved an important improvement in the distribution of the efforts within the carcass, thereby offering a longer lifetime for the tyre. At the same time, the use of elastomeric material of low modulus for the elastic support insert 13 instead of highly stiff elastomeric material as necessarily required in the known art, leads to an important improvement in the ride comfort, without on the other hand reducing the operating self-bearing features of the tyre.

In the connection, the results of practical tests comparing the tyre embodying the solutions shown in Figs. 3 and 4 with a geometrically identical tyre having however an elastic support insert of monolithic form made in accordance with the known art have shown that the tyre of the invention offers a 10% reduction in vertical stiffness and a 50% increase in the distance covered under flat-ride conditions.

In particular, it is pointed out that the invention is also suitable for carcass devoid of the reinforcing inserts 16, 17 which are on the contrary provided in the preferential embodiment herein described.

Claims

1. A self-supporting tyre (1) for motor vehicle wheels, incorporating elastic support inserts in sidewalls thereof, comprising

   - a carcass (2), a tread band (3) disposed on a radially outer surface of said carcass (2), a circumferentially inextensible belt structure (12), positioned on said carcass (2) and radially inner of said tread band (3), said carcass (2) further including:
   - a pair of circumferentially inextensible bead cores (8), each positioned within a bead (6) defined along an inner circumferential edge of the tyre (1);
   - a pair of elastomeric fillers (9) each of which extends along an outer circumferential edge of one of the bead cores (8) and tapers radially outwardly from its respective bead core;
   - at least one carcass ply (10) having radial inner edges folded back around said bead cores (8) and said elastomeric fillers (9);
   - at least one pair of annular elastic support inserts (13) of lenticular sectional form, made of elastomeric material, each of which is secured to an axially inner surface of one of the tyre sidewalls (5) and extends in a radial direction from one of said bead cores (8) to the corresponding one side edge of the belt structure (12),

   characterized in that each of said annular elastic support inserts comprises:

   - a counter core (14) of substantially lenticular sectional form defining the outer end portion of the elastic insert, positioned partly in an area of maximum axial width (13a) of said insert, said counter core (14) substantially extending from the maximum width region (13a) of said tyre to said one side edge of said belt structure (12) and having an axial outwardly facing abutment side (14a) of convex profile facing said carcass ply (10) and partly in contact therewith;
   - an elastically deformable cover (15) defining the inner end portion of the elastic insert, contacting the counter core (14) at least partly on said convex abutment side thereof, said cover (15) substantially extending from the bead core (8) to at most the maximum width region of said tyre, said cover (15) having a dynamic modulus which is lower than a dynamic modulus of said counter core (14).

2. A tyre according to claim 1, characterized in that it further comprises, within each tyre sidewall (5), a first and a second annular reinforcing insert (16, 17) made of elastomeric material, interposed between the first carcass ply (10) and a second carcass ply (11) disposed upon the first carcass ply, said first and second reinforcing inserts (16, 17) exhibiting a substantially lenticular section becoming thinner towards the ends, and being mutually interconnected at a junction point (18) located substantially at the height of the maximum-thickness area (13a) of the elastic support insert (13).

3. A tyre according to claim 2, characterized in that the counter core (14) has its maximum thickness at the maximum-width area of the tyre (1) under completely deflated conditions.

4. A tyre according to claim 2, characterized in that the cover (15) coats the abutment side (14a) of the counter core (14) starting from a radially internal end of said core to near the maximum-thickness area of the same, the remaining part of the abutment side (14a) being applied against said carcass ply (10).

5. A tyre according to claim 1, characterized in that the cover (15) coats the counter core (14) throughout the whole extension of the abutment side (14a) thereof and defines, substantially in opposite directions, radially internal (13b) and radially external (13c) end portions of the elastic support insert (13).

6. A tyre according to claim 5, characterized in that said counter core (14) is located substantially at the maximum-width point exhibited by the tyre (1) under completely deflated conditions.

7. A tyre according to claim 1, characterized in that said cover (15) has a dynamic modulus included between 2 and 6 MPa.

8. A tyre according to claim 1, characterized in that said counter core (14) has a dynamic modulus in the range of 6 to 16 MPa.

9. A tyre according to claim 1, characterized in that the counter core (14) is made of elastomeric material incorporating reinforcing fibers.

10. A tyre according to claim 1, characterized in that the cover (15) at the counter core (14) exhibits a minimum thickness lower than 2,5 mm.

11. A tyre according to claim 1, characterized in that the cross sectional surface extension of the counter core is included between 30% and 60% of the overall cross sectional surface extension of said elastic support insert (13).

12. A tyre according to claim 1, characterized in that the counter core (14) exhibits a maximum radial extension included between 1/4 and 3/4 of the overall radial extension of said elastic support insert (13).

Patentansprüche

1. Selbsttragender Reifen (1) für Kraftfahrzeugräder, der in seinen Seitenwänden elastische Trageinsätze hat

- mit einer Karkasse (2), einem Laufflächenband (3), das auf einer radial äußeren Fläche der Karkasse (2) angeordnet ist, und einem in Umfangsrichtung nicht dehnbaren Gurtaufbau (12), der auf der Karkasse (2) und radial innerhalb des Laufflächenbandes (3) angeordnet ist, wobei die Karkasse (2) weiterhin
- ein Paar von in Umfangsrichtung nicht dehnbaren Wulstkernen (8), von denen jeder in einem Wulst (6) angeordnet ist, der längs eines inneren Umfangsrandes des Reifens (1) ausgebildet ist,
- ein Paar von elastomeren Füllelementen (9), von denen sich jedes längs eines äußeren Umfangsrandes eines der Wulstkerne (8) erstreckt und sich radial nach außen von dem jeweiligen Wulstkern aus verjüngt,
- wenigstens eine Karkassenlage (10), deren radiale innere Ränder um die Wulstkerne (8) und die elastomeren Füllelemente (9) herum zurückgefaltet sind, und
- wenigstens ein Paar von ringförmigen elastischen Trageinsätzen (13) mit im Schnitt Linsenform aufweist, die aus elastomerem Material hergestellt sind und von denen jeder an einer axial inneren Fläche einer der Reifenseitenwände (5) festgelegt ist und sich in einer radialen Richtung von einem der Wulstkerne (8) zu dem entsprechenden einen Seitenrand des Gurtaufbaus (12) erstreckt,

dadurch gekennzeichnet, daß jeder der ringförmigen elastischen Trageinsätze

- einen Gegenkern (14) mit im Schnitt im wesentlichen linsenförmiger Gestalt, der den äußeren Endabschnitt des elastischen Einsatzes bildet, der teilweise in einem Bereich maximaler axialer Breite (13a) des Einsatzes angeordnet ist, wobei der Gegenkern (14) sich im wesentlichen von dem maximalen Breitenbereich (13a) des Reifens zu dem einen Seitenrand des Gurtaufbaus (12) erstreckt und eine axiale, nach außen weisende Widerlagerseite (14a) mit konvexem Profil hat, die der Karkassenlage (10) zugewandt ist und teilweise in Kontakt damit steht, und
- eine elastische verformbare Abdeckung (15) aufweist, welche den inneren Endabschnitt des elastischen Einsatzes bildet, der mit dem Gegenkern (14) wenigstens teilweise an seiner konvexen Widerlagerseite in Berührung steht, wobei die Abdeckung (15) sich im wesentlichen von dem Wulstkern (8) zu höchstens dem maximalen Breitenbereich des Reifens erstreckt und einen dynamischen Modul hat, der niedriger als ein dynamischer Modul des Gegenkerns (14) ist.

2. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß er weiterhin in jeder Reifenseitenwand (5) einen ersten und einen zweiten ringförmigen Verstärkungseinsatz (16, 17) aus elastomerem Material aufweist, der zwischen der ersten Karkassenlage (10) und einer zweiten, auf der ersten Karkassenlage angeordneten Karkassenlage (11) eingesetzt

ist, wobei der erste und der zweite Verstärkungseinsatz (16, 17) einen im wesentlichen linsenförmigen Querschnitt haben, der zu den Enden hin dünner wird, und gegenseitig an einer Verbindungsstelle (18) zusammengeschlossen sind, die sich im wesentlichen auf der Höhe des Bereichs (13a) maximaler Dicke des elastischen Trageinsatzes (13) befindet.

3. Reifen nach Anspruch 2, dadurch gekennzeichnet, daß der Gegenkern (14) seine maximale Dicke an dem Bereich maximaler Breite des Reifens (1) in vollständig entleertem Zustand hat.

4. Reifen nach Anspruch 2, dadurch gekennzeichnet, daß die Abdeckung (15) die Widerlagerseite (14a) des Gegenkerns (14) ausgehend von einem radial inneren Ende des Kerns bis in die Nähe eines Bereichs seiner maximalen Dicke überdeckt, wobei der restliche Teil der Widerlagerseite (14a) gegen die Karkassenlage (10) anliegt.

5. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß die Abdeckung (15) den Gegenkern (14) über der ganzen Erstreckung seiner Widerlagerseite (14a) abdeckt und im wesentlichen in entgegengesetzten Richtungen radial innere (13b) und radial äußere (13c) Endabschnitte des elastischen Trageinsatzes (13) bildet.

6. Reifen nach Anspruch 5, dadurch gekennzeichnet, daß der Gegenkern (14) sich im wesentlichen an dem Punkt maximaler Breite befindet, den der Reifen (1) in vollständig entleertem Zustand hat.

7. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß die Abdeckung (15) einen dynamischen Modul zwischen 2 und 6 MPa hat.

8. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß der Gegenkern (14) einen dynamischen Modul im Bereich von 6 bis 16 MPa hat.

9. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß der Gegenkern (14) aus einem elastomeren Material hergestellt ist, das Verstärkungsfasern aufweist.

10. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß die Abdeckung (15) an dem Gegenkern (14) eine minimale Dicke von weniger als 2,5 mm hat.

11. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß die Querschnittsflächenerstreckung des Gegenkerns zwischen 30 % und 60 % der Gesamtquerschnittsflächenerstreckung des elastischen Trageinsatzes (13) beträgt.

12. Reifen nach Anspruch 1, dadurch gekennzeichnet, daß der Gegenkern (14) eine maximale radiale Erstreckung zwischen 1/4 und 3/4 der gesamten radialen Erstreckung des elastischen Trageinsatzes (13) hat.

Revendications

1. Pneumatique auto-porteur (1) pour roues de véhicule à moteur, comprenant des éléments de support rapportés dans ses flancs, comportant

- une carcasse (2), une bande de roulement (3) disposée sur une surface radialement extérieure de ladite carcasse (2), une structure de ceinture (12) qui n'est pas extensible dans le sens circonférenciel et est positionnée sur ladite carcasse (2) et radialement à l'intérieur de ladite bande de roulement (3), ladite carcasse (2) comprenant, en outre:
- une paire de tringles (8) de talon qui ne sont pas extensibles dans le sens circonférenciel, chacune étant positionnée dans un talon (6) défini le long d'un bord circonférenciel intérieur du pneumatique (1);
- une paire de pièces de remplissage élastomères (9) dont chacune s'étend le long d'un bord circonférenciel extérieur d'une des tringles (8) de talon et diminue d'épaisseur radialement vers l'extérieur depuis sa tringle de talon respective;
- au moins un pli (10) de carcasse comportant des bords intérieurs radiaux repliés autour desdites tringles (8) de talon et desdites pièces de remplissage (9);
- au moins une paire de pièces rapportées élastiques annulaires (13) de support ayant une forme de section droite lenticulaire et constituée d'un matériau élastomère, chacune de ces pièces étant fixée à la surface axialement intérieure d'un des flancs (5) du pneumatique et s'étendant dans une direction radiale depuis l'une desdites tringles (8) de talon jusqu'à un premier bord latéral correspondant de la structure de ceinture (12),

caractérisé en ce que chacune des pièces rapportées annulaires élastiques de support comprend:

- un noyau d'appui (14) ayant une forme de section droite sensiblement lenticulaire définissant la partie d'extrémité extérieure de la pièce rapportée élastique, située partiellement dans une région (13a) de largeur axiale maximale de ladite pièce rapportée, ledit noyau d'appui (14) s'étendant sensiblement depuis la région (13a) de largeur maximale dudit pneumatique jusqu'audit premier bord latéral de ladite struc-

ture de ceinture (12) et ayant un côté (14a), en contact de butée, orienté axialement vers l'extérieur et de profil convexe orienté vers ledit pli (10) de carcasse et partiellement en contact avec ce dernier;

- un revêtement élastiquement déformable (15) définissant la partie d'extrémité intérieure de la pièce rapportée élastique, en contact avec le noyau d'appui (14) au moins partiellement sur le côté convexe, de contact en butée, de ce dernier, ledit revêtement (15) s'étendant sensiblement depuis la tringle (8) de talon jusqu'à, au plus, la région de largeur maximale dudit pneumatique, ledit revêtement (15) ayant un module dynamique qui est inférieur au module dynamique dudit noyau d'appui (14).

2. Pneumatique selon la revendication 1, caractérisé en ce qu'il comprend, en outre, à l'intérieur de chaque flanc (5) du pneumatique, des première et seconde pièces rapportées annulaires de renforcement (16, 17) en matériau élastomère, interposées entre le premier pli (10) de la carcasse et un second pli (11) de la carcasse disposé sur le premier pli de la carcasse, lesdites première et seconde pièces rapportées de renforcement (16, 17) ayant une section de forme sensiblement lenticulaire s'amincissant vers les extrémités et étant mutuellement interconnectées au point de jonction (18) situé sensiblement à la hauteur de la région d'épaisseur maximale (13a) de la pièce rapportée élastique (13) de support.

3. Pneumatique selon la revendication 2, caractérisé en ce que l'épaisseur maximale du noyau d'appui (14) se trouve dans la région de largeur maximale du pneumatique (1) dans des conditions où celui-ci est complètement dégonflé.

4. Pneumatique selon la revendication 2, caractérisé en ce que le revêtement (15) revêt le côté (14a), de contact en butée, du noyau d'appui (14) en partant d'une extrémité radialement intérieure dudit noyau jusque près de la région d'épaisseur maximale de ce dernier, la partie restante du côté (14a), de contact en butée, étant appliquée contre ledit pli (10) de la carcasse.

5. Pneumatique selon la revendication 1, caractérisé en ce que le revêtement (15) revêt le noyau de renforcement (14) sur toute l'étendue du côté (14a), de contact en butée, de ce dernier et définit, sensiblement dans des directions opposées, des parties d'extrémité radialement intérieure (13b) et radialement extérieure (13c) de la pièce rapportée élastique de support (13).

6. Pneumatique selon la revendication 5, caractérisé en ce que ledit noyau d'appui (14) se trouve sensiblement au point de largeur maximale présenté par le pneumatique (1) dans des conditions où celui-ci est complètement dégonflé.

7. Pneumatique selon la revendication 1, caractérisé en ce que ledit revêtement (15) présente un module dynamique compris entre 2 et 6 MPa.

8. Pneumatique selon la revendication 1, caractérisé en ce que ledit noyau de renforcement (14) présente un module dynamique compris entre 6 et 16 MPa.

9. Pneumatique selon la revendication 1, caractérisé en ce que le noyau de renforcement (14) est formé d'un matériau élastomère comprenant des fibres de renforcement.

10. Pneumatique selon la revendication 1, caractérisé en ce que le revêtement (15) au niveau du noyau d'appui (14) présente une épaisseur minimale inférieure à 2,5 mm.

11. Pneumatique selon la revendication 1, caractérisé en ce que l'extension de superficie de section droite du noyau d'appui est comprise entre 30% et 60% de l'extension de superficie globale de section droite de ladite pièce élastique (13) de support.

12. Pneumatique selon la revendication 1, caractérisé en ce que le noyau d'appui (14) présente une extension radiale maximale comprise entre 1/4 et 3/4 de l'extension radiale globale de ladite pièce rapportée élastique (13) de support.

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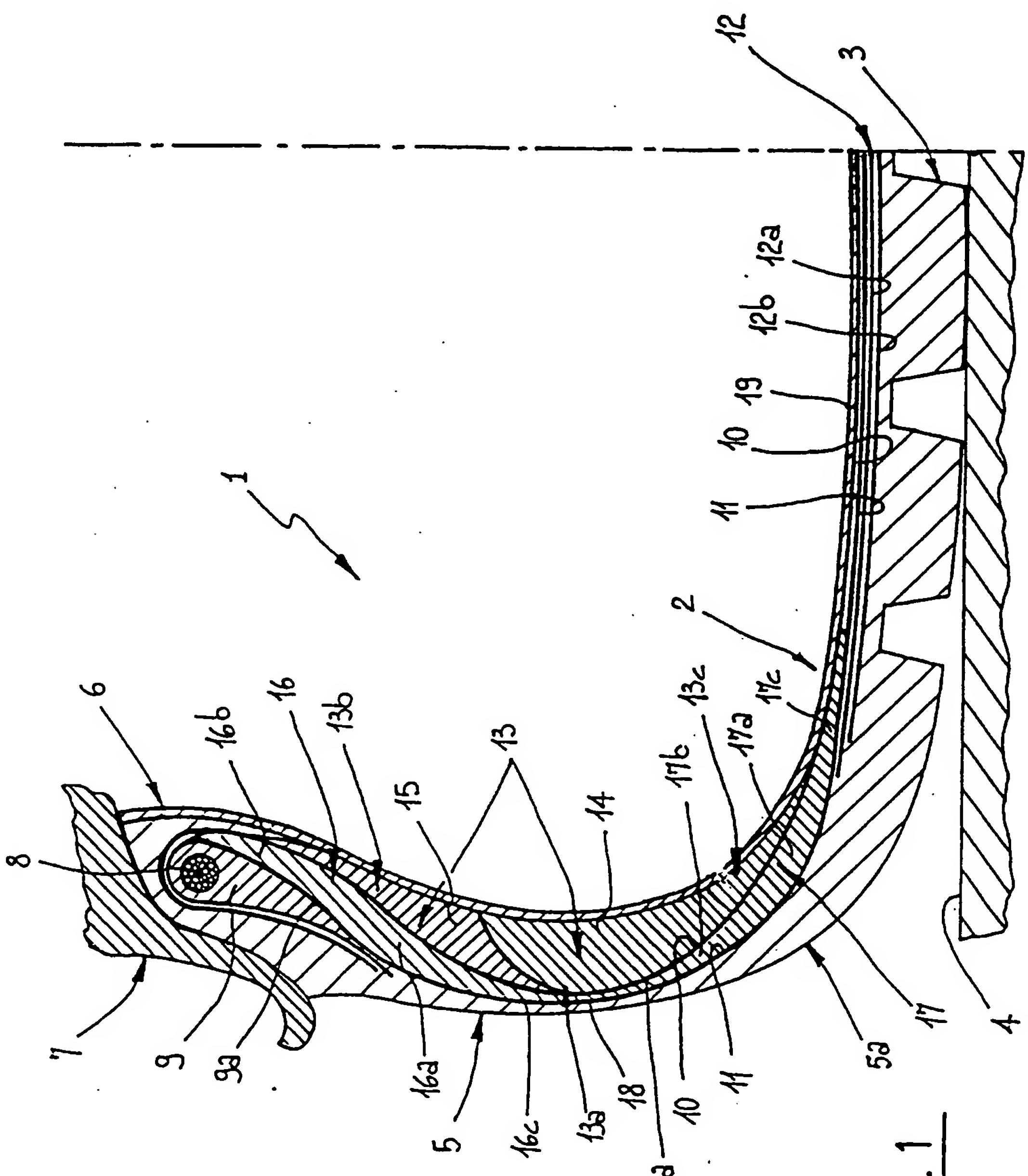

FIG. 1

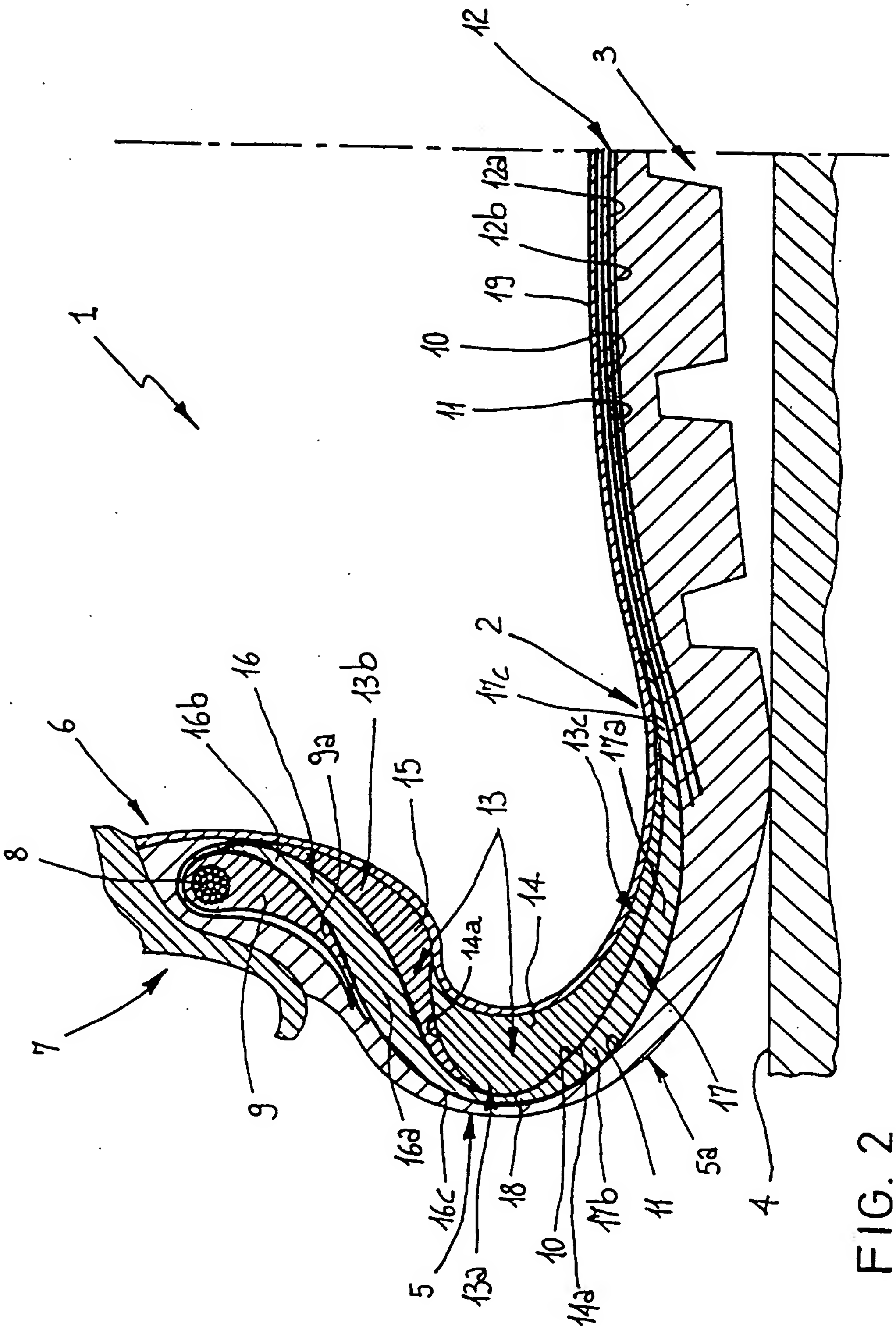
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FIG. 2

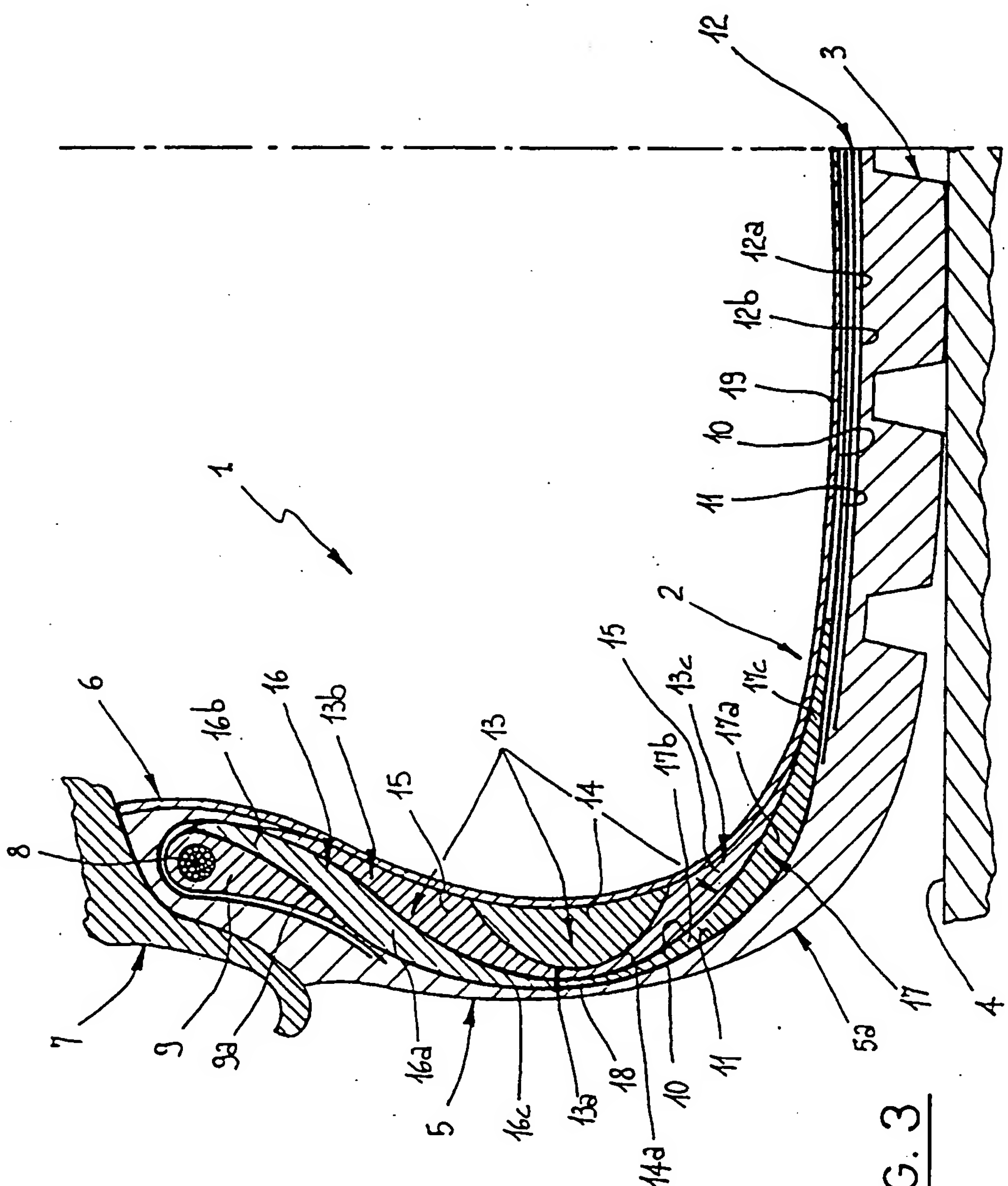
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FIG. 3

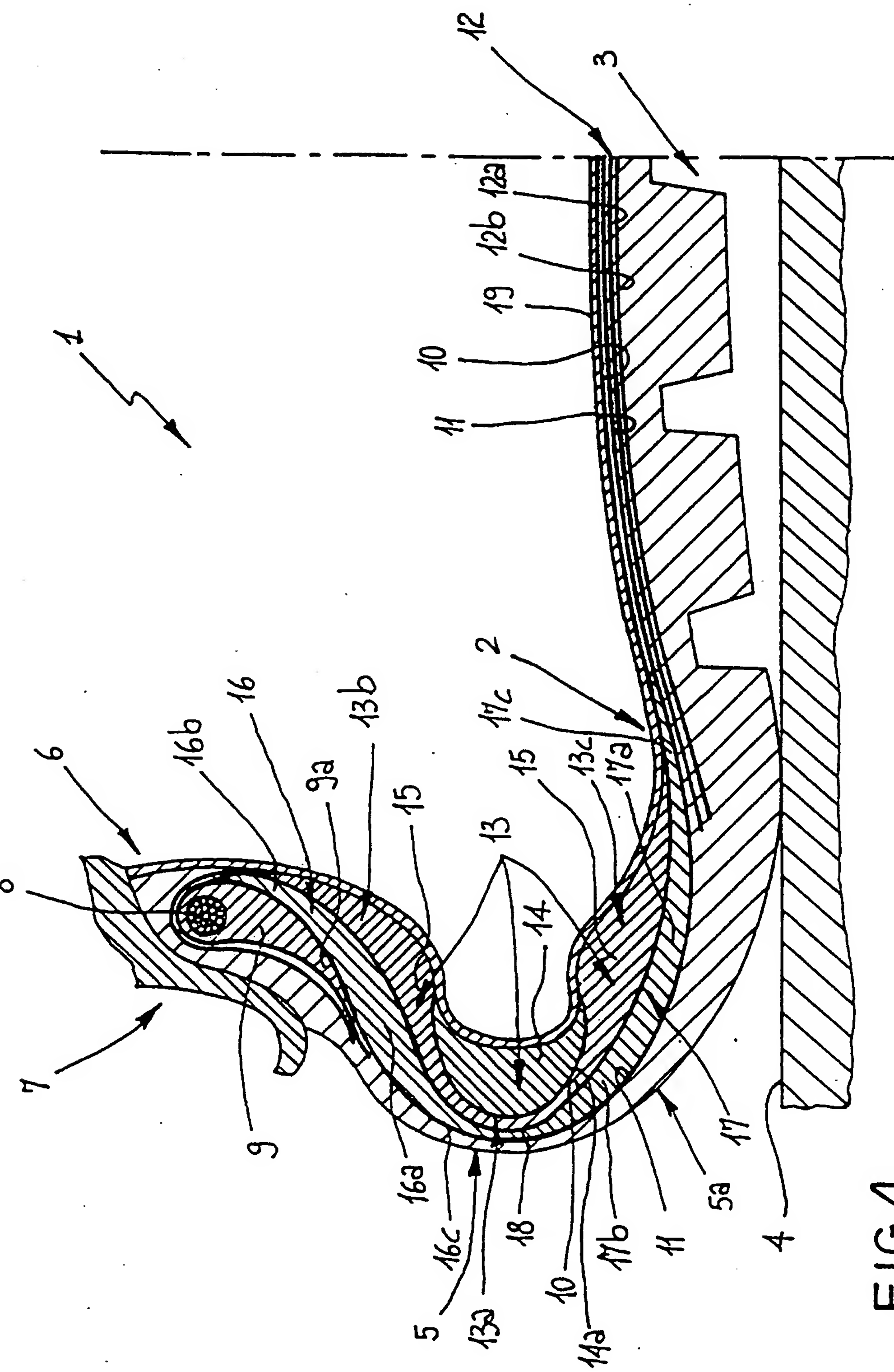

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FIG.4